

WHAT IS CLAIMED IS:

1. A method of forming a virtual private network within a mesh network of nodes, the virtual private network including member nodes selected from the network of nodes, the method comprising the steps of:
 - (a) distributing a membership message to the member nodes, said membership message including a VPN identifier;
 - (b) at each member node, determining a topology for the virtual private network, wherein for each of the member nodes said topology identifies at least one adjacent member node; and
 - (c) creating label switched paths between the member nodes and their adjacent member nodes, thereby establishing the virtual private network having said topology.
2. The method claimed in claim 1, wherein said step of creating label switched paths includes sending MPLS/GMPLS set-up control messaging.
3. The method claimed in claim 1, wherein said topology is a ring and wherein said step of creating label switched paths establishes a closed-loop sequence of label switched path.
4. The method claimed in claim 3, wherein said membership message includes relative position information, said relative position information specifying the position of the member node on said ring relative to the other member nodes.
5. The method claimed in claim 4, wherein said relative position information includes a sortable value, and

wherein said step of determining said topology includes sorting said relative position information.

6. The method claimed in claim 5, wherein said relative position information includes an ordinal, and wherein said step of determining topology includes identifying two adjacent member nodes as the member node having the next highest ordinal and the member node having the next lowest ordinal.
7. The method claimed in claim 3, further including a step of adding a new member node, two of the member nodes being neighbour member nodes to said new member node on said ring, wherein said step of adding a new member node includes creating label switched path segments between said new member node and each of said neighbour member nodes before dropping a label switched path segment between said neighbour member nodes.
8. The method claimed in claim 3, further including a step of removing a selected member node, two of the member nodes being neighbour member nodes to said selected member node on said ring, wherein said step of removing includes creating a label switched path segment between said neighbour member nodes before dropping label switched paths between said selected node and each of said neighbour member nodes.
9. The method claimed in claim 1, further including a step of populating a forwarding table at the member nodes.
10. The method claimed in claim 1, further including a step of providing a signalling protocol on said label switched paths having a multi-level label stack.

11. The method claimed in claim 10, wherein said multi-level label stack includes a first layer label identifying a tunnel label and a second layer label identifying an egress member node label.
12. The method claimed in claim 11, wherein said multi-level label stack further includes a third layer label providing a network differentiator.
13. The method claimed in claim 1, further including a step of broadcasting a data packet from one of the member nodes to the other member nodes over the virtual private network.
14. A computer program product having a computer-readable medium tangibly embodying computer executable instructions for creating a virtual private network within a mesh network of nodes, the virtual private network including member nodes selected from the network of nodes, the computer executable instructions comprising:
 - (a) computer executable instructions for distributing a membership message to the member nodes, said membership message including a VPN identifier;
 - (b) computer executable instructions for determining, at each member node, a topology for the virtual private network, wherein for each of the member nodes said topology identifies at least one adjacent member node; and
 - (c) computer executable instructions for creating label switched paths between the member nodes and their adjacent member nodes, thereby establishing the virtual private network having said topology.
15. The computer program product claimed in claim 14,

wherein said computer executable instructions for creating label switched paths include computer executable instructions for sending MPLS/GMPLS set-up control messaging.

16. The computer program product claimed in claim 14, wherein said topology is a ring and wherein said computer executable instructions for creating label switched paths establish a closed-loop sequence of label switched paths.
17. The computer program product claimed in claim 16, wherein said membership message includes relative position information, said relative position information specifying the position of the member node on said ring relative to the other member nodes.
18. The computer program product claimed in claim 17, wherein said relative position information includes a sortable value, and wherein said computer executable instructions for determining said topology includes computer executable instructions for sorting said relative position information.
19. The computer program product claimed in claim 18, wherein said relative position information includes an ordinal, and wherein said computer executable instructions for determining topology include computer executable instructions for identifying two adjacent member nodes as the member node having the next highest ordinal and the member node having the next lowest ordinal.
20. The computer program product claimed in claim 16, further including computer executable instructions for adding a new member node, two of the member nodes being neighbour member nodes to said new

member node on said ring, wherein said computer executable instructions for adding a new member node include computer executable instructions for creating label switched path segments between said new member node and each of said neighbour member nodes before dropping a label switched path segment between said neighbour member nodes.

21. The computer program product claimed in claim 16, further including computer executable instructions for removing a selected member node, two of the member nodes being neighbour member nodes to said selected member node on said ring, wherein said computer executable instructions for removing said selected member node include computer executable instructions for creating a label switched path segment between said neighbour member nodes before dropping label switched paths between said selected node and each of said neighbour member nodes.
22. The computer program product claimed in claim 14, further including computer executable instructions for populating a forwarding table at the member nodes.
23. The computer program product claimed in claim 14, further including computer executable instructions for providing a signalling protocol on said label switched paths having a multi-level label stack.
24. The computer program product claimed in claim 23, wherein said multi-level label stack includes a first layer label identifying a tunnel label and a second layer label identifying an egress member node label.
25. The computer program product claimed in claim 24, wherein said multi-level label stack further

includes a third layer label providing a network differentiator.

26. The computer program product claimed in claim 14, further including computer executable instructions for broadcasting a data packet from one of the member nodes to the other member nodes over the virtual private network.
27. A system for forming a virtual private network within a mesh network of nodes, the virtual private network including member nodes selected from the network of nodes, the system comprising:
 - (a) means for distributing a membership message to the member nodes, said membership message including a VPN identifier;
 - (b) means for determining a topology for the virtual private network, wherein for each of the member nodes said topology identifies at least one adjacent member node; and
 - (c) means for creating label switched paths between the member nodes and their adjacent member nodes, thereby establishing the virtual private network.
28. The system claimed in claim 27, wherein said means for creating label switched paths includes means for sending control messaging based upon a protocol selected from the group including MPLS, GMPLS, ASTN, OUNI, and PNNI.
29. The system claimed in claim 27, wherein said topology is a ring and wherein said means for creating label switched paths establishes a closed-loop sequence of label switched paths.
30. The system claimed in claim 29, wherein said membership message includes relative position

information, said relative position information specifying the position of the member node on said ring relative to the other member nodes.

31. The system claimed in claim 30, wherein said relative position information includes a sortable value, and wherein said means for determining said topology includes means for sorting said relative position information.
32. The system claimed in claim 31, wherein said relative position information includes an ordinal, and wherein said means for determining a topology includes means for identifying two adjacent member nodes as the member node having the next highest ordinal and the member node having the next lowest ordinal.
33. The system claimed in claim 29, further including means for adding a new member node, two of the member nodes being neighbour member nodes to said new member node on said ring, wherein said means for adding a new member node includes means for creating label switched path segments between said new member node and each of said neighbour member nodes before dropping a label switched path segment between said neighbour member nodes.
34. The system claimed in claim 29, further including means for removing a selected member node, two of the member nodes being neighbour member nodes to said selected member node on said ring, wherein said means for removing includes means for creating a label switched path segment between said neighbour member nodes before dropping label switched paths between said selected node and each of said neighbour member nodes.

35. The system claimed in claim 27, further including a means for populating a forwarding table at the member nodes.
36. The system claimed in claim 27, further including means for providing a signalling protocol on said label switched paths having a multi-level label stack.
37. The system claimed in claim 36, wherein said multi-level label stack includes a first layer label identifying a tunnel label and a second layer label identifying an egress member node label.
38. The system claimed in claim 37, wherein said multi-level label stack further includes a third layer label providing a network differentiator.
39. The system claimed in claim 27, further including means for broadcasting a data packet from one of the member nodes to the other member nodes over the virtual private network.
40. A system for forming a virtual private network within a mesh network of nodes, the system comprising:
 - member nodes selected from the network of nodes, wherein said member nodes receive a membership message, said membership message including a VPN identifier, and wherein said member nodes include a topology module for determining a topology for the virtual private network, wherein for each of said member nodes said topology identifies at least one adjacent member node; and
 - label switched paths between said member nodes and their adjacent member nodes, wherein said label switched paths establish the virtual private

network.

41. The system claimed in claim 40, wherein said topology is a ring and wherein said label switched paths form a closed-loop sequence of label switched paths.
42. The system claimed in claim 41, wherein said membership message includes relative position information, said relative position information specifying the position of the member node on said ring relative to the other member nodes.
43. The system claimed in claim 42, wherein said relative position information includes a sortable value, and wherein said topology module includes a sorting module for sorting said relative position information.
44. The system claimed in claim 43, wherein said relative position information includes an ordinal, and wherein said topology module identifies two adjacent member nodes as said member node having the next highest ordinal and said member node having the next lowest ordinal.
45. The system claimed in claim 40, wherein said member nodes include a forwarding table.
46. The system claimed in claim 40, wherein said label switched paths support a signalling protocol having a multi-level label stack.
47. The system claimed in claim 46, wherein said multi-level label stack includes a first layer label identifying a tunnel label and a second layer label identifying an egress member node label.
48. The system claimed in claim 47, wherein said multi-level label stack further includes a third layer

label providing a network differentiator.

49. The system claimed in claim 40, wherein one of said member nodes broadcasts a data packet to the other said member nodes over the virtual private network.